



Published in final edited form as:  
*SRS Bull.* 2013 ; 19(1): 15–17.

## CDC's Public Health Surveillance of Sleep Health

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The Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH) are separate public health federal agencies in the Department of Health and Human Services (HHS). The mission of the CDC involves collaborating to create the expertise, information, and tools that people and communities need to protect their health—through health promotion, prevention of disease, injury, and disability, and preparedness for new health threats (<http://www.cdc.gov/about/organization/mission.htm>). The CDC seeks to accomplish that mission by working with partners throughout the nation and the world to monitor health; detect and investigate health problems; conduct research to enhance prevention; develop and advocate sound public health policies; implement prevention strategies; promote healthy behaviors; foster safe and healthful environments; and provide leadership and training. Thus, the CDC collaborates with the NIH's National Heart, Lung, and Blood Institute (NHLBI) and other partners to promote sleep health.

An important and essential public health function of the CDC is to implement national and state surveillance and data collection systems to monitor the health of the nation. The National Health Interview Survey (NHIS), an interviewer-administered household survey of a probability sample of the civilian, non-institutionalized US population has included sleep indicators (1-5). Estimates can be obtained for the US and geographic regions. Oversampling of population subgroups defined by race and ethnicity increases the precision of the estimates for these groups. Information on sleep duration during a 24-hour period was collected for adults in 1985, 1990, and annually since 2004. Questions on insomnia or trouble sleeping and/or excessive sleepiness were included in 2002, 2007, and 2012 in the NHIS. The National Health and Nutrition Examination Survey (NHANES), a nationally representative survey of the civilian, non-institutionalized US population that includes interviews, examinations, and laboratory tests, has included questions about sleep duration and various sleep disorders including sleep apnea, snoring, restless legs syndrome, and insomnia starting with the 2005-2006 survey cycle for adults aged 16 years and older (6-8). Assessments of the pharmacologic treatment of sleep difficulties and physician-reported diagnosis of sleep apnea of nationally representative samples of outpatient physician visits have been possible through analysis of the annual National Ambulatory Medical Care Survey (NAMCS) (9, 10). The National Hospital Discharge Survey (NHDS), an annual sample of hospital discharges from nonfederal short-stay hospitals from 1965-2010, provides information about hospital stays including discharge diagnoses and procedures

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codes. Analysis of NHDS data has resulted in an assessment of the use of continuous positive airway pressure therapy during hospitalizations for sleep apnea (11). Starting in 2007 and continuing in odd years, the Youth Risk Behavior Survey (YRBS) asks about sleep duration during the average school night of a representative sample of students in the 9<sup>th</sup> through 12<sup>th</sup> grades attending US public and private schools (12). In 2008, the state health departments in all 50 states and US territories in collaboration with the CDC began to collect information on perceived sleep insufficiency in the Behavioral Risk Factor Surveillance System (BRFSS) (13). The BRFSS is a state-based, random-digit-dialed telephone survey of the non-institutionalized US population aged 18 years; there were over 400,000 respondents in 2008. A unique feature of this large database is that analyses have allowed state-level identification of a geographic clustering of poor sleep health in the southern US (13, 14). The considerably large sample size has also allowed the first identification of a higher prevalence of poor sleep health in American Indian/Alaska Native populations compared to other racial/ethnic groups (15). Self-selected states have also implemented a specific module with sleep indicators including sleep duration, snoring, and drowsy driving that allows additional assessments of important public health and safety concerns related to poor sleep health (16-18).

Certainly these national and state surveys have limitations. Unlike measures in many sleep research or clinical studies, self-reported sleep indicators for survey respondents cannot be validated with medical records, polysomnography measurements, or other objective sleep measurements—the costs would be prohibitive for such relatively large population samples. NAMCS is a nationally representative sample of visits to office-based physicians and NHDS is a nationally representative sample of discharges from short-stay hospitals; therefore, caution must be used in interpreting the data because the samples are not a representative sample of the US population. For CDC surveys such as NHDS and NAMCS, which collect information directly from hospital and outpatient medical records, information is not available about either severity of the sleep disorder or about whether the sleep disorder diagnosis or procedure is the first (incident) occurrence or an ongoing (prevalent) measure. NAMCS does collect information about whether the reason for the visit is a new or recurring problem and whether a prescription was new or continued. Except when the National Death Index, Medicare claims, or Medicaid claims data have been linked with NHIS or NHANES to create longitudinal studies, information from the NHIS or NHANES is cross-sectional; thus, temporality between the sleep indicator and other risk factors or outcomes cannot be established. Finally, the small number of sleep questions used in these national data systems cannot replicate the multiple Epworth and Berlin questions that are often used in sleep research and clinical studies to determine poor sleep health because national data systems are designed to measure a broader variety of health indicators than just those used in sleep studies—again the cost would be prohibitive.

A major value of the NHANES, NHIS, and BRFSS is that the sleep information can be linked to a wide variety of health measurements. Furthermore, in contrast to sleep research or clinical studies, NHANES and NHIS collect sleep health information on a relatively large representative random sample of the general US population; similarly BRFSS collects information on a random sample of state adult populations. Such information, in contrast to information collected on a carefully restricted and perhaps more homogeneous research

study sample, provides guidance to public health programs about the burden of poor sleep health and informs decision-makers who are responsible for setting public health priorities, developing or promoting sleep-related policies, and leveraging limited public health resources to promote sleep health and safety.

Healthy People 2020 is an example of a national collaborative effort to provide science-based, 10-year objectives for improving the health of all Americans; identify nationwide health improvement priorities; and engage multiple sectors (public health agencies, organizations, academia, medicine, and communities) to take actions to strengthen policies and improve practices that are driven by the best available scientific knowledge and evidence (<http://www.healthypeople.gov/2020/topicsobjectives2020/>). Table 1 describes the four Healthy People 2020 objectives for sleep health. One goal for setting these sleep health objectives is to increase public knowledge of how adequate sleep and treatment of sleep disorders improve health, productivity, quality of life, and safety on roads and in the workplace. Progress in reaching target levels by 2020 for three of these objectives will be monitored by CDC surveys (NHANES, NHIS, and YRBS) in the general US population of adults and adolescents.

As described by the NHLBI, planning for the future of sleep health research includes providing training to develop the next generation of highly skilled sleep epidemiologists. These CDC surveys and surveillance systems provide sleep research trainees with additional, low-cost opportunities to supplement the development and refinement of their skills in data analysis, data interpretation, and manuscript preparation in a time of limited research and project funding. In addition, such low-cost efforts may generate new hypotheses about sleep health and/or spark interest and innovation in the development of new surveillance measurements to further the monitoring of sleep health—a much understudied public health issue.

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**Table 1**  
**Healthy People 2020 Objectives for Sleep Health**

HP 2020 Objective	Data Source	Baseline	Target
SH-1: Increase the proportion of persons with symptoms of obstructive sleep apnea who seek medical evaluation.	National Health and Nutrition Examination Survey (NHANES), CDC	25.5% of persons with symptoms of obstructive sleep apnea sought medical evaluation in 2005-2008 (age-adjusted to the year 2000 standard population)	28.0%
SH-2: Reduce the rate of vehicular crashes per 100 million miles traveled that are due to drowsy driving.	General Estimates System (GES), Department of Transportation, National Highway Traffic Safety Administration	2.7 vehicular crashes per 100 million miles traveled involved drowsy driving in 2008	2.1 vehicular crashes per 100 million miles traveled
SH-3: Increase the proportion of students in grades 9 through 12 who get sufficient sleep.	Youth Risk Behavior Surveillance System (YRBS), CDC	30.9% of students in grades 9 through 12 got sufficient sleep (defined as 8 hours on average school night) in 2009	33.2%
SH-4: Increase the proportion of adults who get sufficient sleep.	National Health Interview Survey (NHIS), CDC	69.6% of adults got sufficient sleep (defined as 8 hours for those aged 18-21 years and 7 hours for those aged 22 years, on average during a 24-hour period) in 2008	70.9%

Source: <http://www.healthypeople.gov/2020/topicsobjectives2020/>